

ENVIRONMENTAL MONITORING AND ASSESSMENT PROGRAM SURFACE WATERS FIELD OPERATIONS MANUAL FOR LAKES

The information in this Adobe Acrobat Reader PDF file is one of several PDF files extracted from this report. The PDF files from the report are:

lake_ove.pdf	Overview of EMAP Surface Waters Lake Sampling, daily operations, lake verification and index site location, and general lake assessment (Sections 1, 2, 3, 4, 9)
lake_hab.pdf	Protocols for temperature, dissolved oxygen, shoreline physical habitat (Section 5)
lake_fis.pdf	Protocols for fish sampling (Section 6)
lake_wat.pdf	Protocols for Secchi transparency, water sample collection, chlorophyll a, zooplankton, sediment diatom (Section 7)
lake_ben.pdf	Protocols for benthic invertebrate sampling (Section 8)
lake_avi.pdf	Protocols for avian assemblages (Appendix A)
lake_vis.pdf	Lake-Visit Checklists for all Field Measurements (Appendix B)
field_for.pdf	Field Data Forms for all Field Measurements (Appendix C)

The Table of Contents, acknowledgments, notice page, listing of figures, listing of tables, and listing of acronyms for the document appear at the end of each pdf file.

In all cases, the source for this information for citation purposes is:

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EPA/620/R-97/001. U.S. Environmental Protection Agency, Washington D.C.

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**ENVIRONMENTAL MONITORING AND ASSESSMENT PROGRAM
SURFACE WATERS
FIELD OPERATIONS MANUAL FOR LAKES**

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ABSTRACT

The methods and instructions for field operations presented in this manual for lake surveys were developed and tested through 4 years of pilot and demonstration projects from 1991 through 1994. These projects were conducted under the sponsorship of the U.S. Environmental Protection Agency and its collaborators through the Environmental Monitoring and Assessment Program (EMAP). This program focuses on evaluating ecological conditions on regional and national scales. This document describes procedures for collecting data, samples, and information about biotic assemblages, environmental measures, or attributes of indicators of lake ecosystem condition. The procedures presented in this manual were developed based on standard or accepted methods, modified as necessary to adapt them to EMAP sampling requirements. In addition to methodology, additional information on data management and other logistical aspects is integrated into the procedures and overall operational scenario. Procedures are described for collecting chlorophyll *a*, water, sedimentary diatoms, and zooplankton data in conjunction with the development of standard methods to obtain acceptable index samples for macrobenthos, fish assemblage, fish tissue contaminants, riparian birds, and physical habitat structure. The manual describes field implementation of these methods and the logistical foundation constructed during field projects. The manual includes flow charts with overall summaries of specific field activities required to visit a lake site and collect data for these indicators. Tables give step-by-step protocol instructions. These figures and tables can be extracted and bound separately to make a convenient quick field reference for field teams. The manual also includes example field data forms for recording measurements and observations made in the field and sample tracking information. Checklists of all supplies and equipment needed for each field task are included to help ensure that these materials are available when required.

APPENDIX C

FIELD DATA FORMS

Field data forms are presented in the general order of their use at each lake:

1. Lake Verification Form
2. Lake Profile Form
3. Physical Habitat Characterization Form--Lakes
4. Physical Habitat Characterization Comment Form
5. Physical Habitat Sketch Map Form
6. Fish Tally Form--Lakes
7. Fish Tally Continuation Form--Lakes
8. Fish Length Form--Lakes
9. Fish Tissue Sample Tracking Form--Lakes
10. Sample Collection Form--Lakes
11. Benthos Sample Location and Collection Form--Lakes
12. Lake Assessment Form

LAKE VERIFICATION FORM

LAKE NAME: _____ DATE OF VISIT: / / VISIT #: 1 2

LAKE ID: _ _ _ _ _ L MODE OF ACCESS: VEHICLE HIKE-IN AIRCRAFT

TEAM ID (CIRCLE): 1 2 3 4 5 6 7 8 9 10 OTHER: _____

ARROW INDICATES NORTH

MARK SITE: L = LAUNCH X = INDEX

LAKE VERIFICATION INFORMATION

LAKE SHAPE COMPARES TO MAP? ☐ YES ☐ NO

LAKE VERIFIED BY (✓ all that apply) : ☐ GPS ☐ LOCAL CONTACT ☐ SIGNS ☐ ROADS ☐ TOPO. MAP

☐ Other (Describe Here):

☐ NOT VERIFIED (Explain in Comments)

COORDINATES	LATITUDE (dd mm ss) North	LONGITUDE (ddd mm ss) West	TYPE OF GPS FIX	SIGNAL QUALITY	GEOMETRIC QUALITY	Are GPS Coordinates w/i ±1 min. of map?
Map:	_____ " _____ ' _____ "	_____ " _____ ' _____ "				
Launch Site:	_____ " _____ ' _____ "	_____ " _____ ' _____ "	<input type="checkbox"/> 2D <input type="checkbox"/> 3D	_____	_____	<input type="checkbox"/> YES <input type="checkbox"/> NO
Index Site:	_____ " _____ ' _____ "	_____ " _____ ' _____ "	<input type="checkbox"/> 2D <input type="checkbox"/> 3D	_____	_____	<input type="checkbox"/> YES <input type="checkbox"/> NO

**LAKE
SAMPLED?**

REASON NOT SAMPLED (EXPLAIN BELOW): ☐ NOT VISITED ☐ NON-TARGET ☐ INACCESSIBLE ☐ OTHER

Explanation:

☐ YES ☐ NO

CHECK HERE IF
EXPLANATION IS
CONTINUED ON BACK.

☐

DESCRIBE LAUNCH SITE, LAKE DIRECTIONS, AND ADD COMMENTS ON BACK

REVIEWED BY (INITIAL): _____

LAKE ID: _____ L

LAKE VERIFICATION FORM (continued)

VISIT #: 1 2

DIRECTIONS TO LAKE & LAUNCH SITE

LAUNCH SITE DESCRIPTION

GENERAL COMMENTS

EXPLANATION FOR NOT SAMPLING THE LAKE (continued from front)

REVIEWED BY (INITIAL): _____

LAKE PROFILE FORM

LAKE NAME:	DATE OF PROFILE:	/	/	VISIT #:	1	2
------------	------------------	---	---	----------	---	---

LAKE ID: _____ L SITE ID (circle): INDEX OTHER: _____

TEAM ID (circle): 1 2 3 4 5 6 7 8 9 10 OTHER: ____

PRECIPITATION (circle): **NONE** **LIGHT** **HEAVY**

SURFACE CONDITIONS (circle):	FLAT	RIPPLES	CHOPPY	WHITECAPS
-------------------------------------	-------------	----------------	---------------	------------------

ODOR? <input type="checkbox"/> No <input type="checkbox"/> YES	Description:
--	--------------

SCUM? <input type="checkbox"/> No <input type="checkbox"/> YES	Description:
---	---------------------

INDEX SITE DEPTH: ____ . ____ M CHECK (✓) IF SONAR NOT USED:

FLAG:	COMMENTS:
-------	-----------

--	--

DISSOLVED OXYGEN & TEMPERATURE PROFILE

(Depth of Measurement^a [m]: Surface, 1.5, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 20, 25, 30, 35, 40, 45, and 50 m),
Also include readings at 1 m above bottom.

[illegible]

IS THE DUPLICATE O₂ READING WITHIN ± 0.5 MG/L OF THE INITIAL SURFACE READING? ☐ YES ☐ NO

CHECK HERE IF ADDITIONAL PROFILE MEASUREMENTS ARE RECORDED ON THE REVERSE SIDE: _____

^a If the site depth is ≤ 3 m, take readings at the surface, every 0.5 m, and 1 m above the bottom.

^b METALIMNION = The region of the profile where the temperature changes at a rate of 1 °C or greater per meter of depth. Indicate the depth of the top of the metalimnion with a "T," and the bottom of the metalimnion (when the rate of change becomes less than 1 °C per meter) with a "B." After the metalimnion is encountered, take readings every 1 m until bottom of the metalimnion is reached. Record the depth of the top of the metalimnion on the Benthos Sample Location and Collection Form.

FLAG CODES: K = NO MEASUREMENT OR OBSERVATION MADE; U = SUSPECT MEASUREMENT OR OBSERVATION; Q = UNACCEPTABLE QC CHECK ASSOCIATED WITH MEASUREMENT; F1, F2, ETC. = MISCELLANEOUS FLAGS ASSIGNED BY EACH FIELD CREW. EXPLAIN ALL FLAGS IN COMMENTS SECTION ON BACK OF FORM.

REVIEWED BY (INITIAL): _____

LAKE ID: _____ L

LAKE PROFILE FORM (continued)

VISIT #: 1 2

OXYGEN METER CALIBRATION INFORMATION

SALINITY KNOB AT "0-FRESH": ☐MEMBRANE CHECK ☐ELECTRONIC ZERO ☐RED LINE: ☐

CALIBRATION CHAMBER TEMPERATURE: _____ °C

SATURATED O₂ @ CHAMBER TEMP.: _____ MG/LLAKE ELEVATION
(FROM TOPO. MAP OR ALTIMETER): _____ FT

ELEVATION CORRECTION FACTOR: ×

THE CALIBRATION VALUE IS OBTAINED BY MULTIPLYING THE SATURATED O₂ CONCENTRATION TIMES AN ELEVATION CORRECTION FACTOR (BOTH VALUES ARE OBTAINED FROM TABLES PRESENT ON THE BACK OF THE METER, OR PROVIDED IN THE MANUFACTURER'S OPERATIONS MANUAL). ADJUST THE METER READING TO THE CALIBRATION VALUE.

CALIBRATION VALUE: _____ MG/L

FLAG

COMMENTS

DISSOLVED OXYGEN & TEMPERATURE PROFILE (continued)

For depths >15 m, continue recording at 5-m intervals)

DEPTH (m) xx.x	O ₂ (mg/L) xx.x	TEMP. (°C) xx.x	FLAG	META- LIMNION (T, B) ^a	DEPTH (m) xx.x	O ₂ (mg/L) xx.x	TEMP. (°C) xx.x	FLAG	META- LIMNION (T,B) ^b

DEPTH & FLAG	COMMENTS

REVIEWED BY (INITIAL): _____

PHYSICAL HABITAT CHARACTERIZATION FORM-LAKES

LAKE NAME:

DATE OF VISIT: / /

VISIT #: 1 2

LAKE ID: L

TEAM ID (circle): 1 2 3 4 5 6 7 8 9 10 OTHER:

NEW STATION ID (if needed):

RIPARIAN ZONE

STATION ID:

A

B

C

D

E

F

G

H

I

J

VEGETATION TYPE

N=NONE, D= DECID., C=CONIF., M=MIXED

CANOPY LAYER (> 5 M)

UNDERSTORY (0.5 TO 5 M)

AREAL COVERAGE CATEGORIES 0 = ABSENT 1 = SPARSE (<10%) 2 = MODERATE (10 TO 40%) 3 = HEAVY (40 TO 75%) 4 = VERY HEAVY (> 75%)

CANOPY LAYER
(> 5 M HEIGHT)

TREES ≥ 0.3 M DBH

TREES < 0.3 M DBH

UNDERSTORY
(HEIGHT=0.5 TO 5 M)

WOODY SHRUBS & SAPLINGS

TALL HERBS, FORBS, & GRASSES

GROUND COVER
(< 0.5 M HEIGHT)

WOODY SHRUBS & SEEDLINGS

HERBS, FORBS, & GRASSES

STANDING WATER OR INUNDATED VEGETATION

BARREN OR BUILDINGS

SHORELINE
SUBSTRATE
ZONE

BEDROCK (> 4000 MM; BIGGER THAN A CAR)

BOULDERS (250 - 4000 MM; BASKETBALL - CAR SIZE)

COBBLE/GRAVEL (2 - 250 MM; LADYBUG - BASKETBALL SIZE)

LOOSE SAND (0.06 TO 2 MM; GRITTY BETWEEN FINGERS)

OTHER FINE SOIL/SEDIMENT (< 0.06 MM; NOT GRITTY)

VEGETATED

OTHER (EXPLAIN IN COMMENTS)

BANK
FEATURES
(WITHIN PLOT)

ANGLE: V = NEAR VERTICAL/UNDERCUT, S = 30-75° , G =<30°

VERTICAL DISTANCE (M) FROM WATERLINE TO HIGH-WATER MARK

HORIZONTAL DISTANCE (M) FROM WATERLINE TO HIGH-WATER MARK

HUMAN INFLUENCE

0 = ABSENT

CHECK (✓) = PRESENT WITHIN PLOT

B = OBSERVED ADJACENT TO OR BEHIND PLOT

BUILDINGS

COMMERCIAL

PARK FACILITIES

DOCKS/BOATS

WALLS, DIKES, OR REVETMENTS

LITTER, TRASH DUMP, OR LANDFILL

ROADS OR RAILROAD

ROW CROPS

PASTURE OR HAYFIELD

ORCHARD

LAWN

OTHER (EXPLAIN IN COMMENTS)

FLAG CODES: K = MEASUREMENT OR OBSERVATION NOT OBTAINED; U = SUSPECT MEASUREMENT OR OBSERVATION;
F1, F2, ETC. = MISC. FLAGS ASSIGNED BY EACH FIELD CREW. EXPLAIN ALL FLAGS ON SEPARATE COMMENTS FORM.

REVIEWED BY (INITIAL):

LAKE ID: _____ L PHYSICAL HABITAT CHARACTERIZATION FORM (continued)										VISIT #: 1 2									
NEW STATION ID (if needed):																			
LITTORAL ZONE					STATION ID:					A	B	C	D	E	F	G	H	I	J
STATION DEPTH (M) AT 10 M OFFSHORE																			
SURFACE FILM TYPE (S=SCUM, A=ALGAL MAT, P=OILY, N=NONE/OTHER)																			
BOTTOM SUBSTRATE: AREAL COVERAGE: 0=ABSENT 1=SPARSE (<10%) 2=MODERATE (10 TO 40%) 3=HEAVY (40 TO 75%) 4=VERY HEAVY (>75%)																			
BEDROCK (>4000 MM; LARGER THAN A CAR)																			
BOULDERS (250 - 4000 MM; BASKETBALL - CAR SIZE)																			
COBBLE (64 - 250 MM; TENNIS BALL - BASKETBALL SIZE)																			
GRAVEL (2 TO 64 MM; LADYBUG TO TENNIS BALL SIZE)																			
SAND (0.06 TO 2 MM; GRITTY BETWEEN FINGERS)																			
SILT. CLAY, OR MUCK (< 0.06 MM; NOT GRITTY)																			
WOODY DEBRIS																			
COLOR (BL=BLACK, GY=GRAY, BR=BROWN, RD=RED, N=NONE OR OTHER)																			
ODOR (S=H ₂ S, A=ANOXIC, P=OIL, C=CHEMICAL, N=NONE)																			
MACROPHYTES AREAL COVERAGE: 0=ABSENT 1=SPARSE (<10%) 2=MODERATE (10 TO 40%) 3=HEAVY (40 TO 75%) 4=VERY HEAVY(>75%)																			
SUBMERGENT																			
EMERGENT																			
FLOATING																			
TOTAL WEED COVER																			
DO MACROPHYTES EXTEND LAKEWARD? (Y OR N)?																			
FISH COVER 0=ABSENT 1=PRESENT BUT SPARSE 2=PRESENT IN MODERATE TO VERY HEAVY DENSITY																			
AQUATIC WEEDS																			
SNAGS > 0.3 M DIAMETER																			
BRUSH OR WOODY DEBRIS < 0.3 M DIAMETER																			
INUNDATED LIVE TREES > 0.3 M DIAMETER																			
OVERHANGING VEGETATION < 1 M ABOVE SURFACE																			
ROCK LEDGES OR SHARP DROPOFFS																			
BOULDERS																			
HUMAN STRUCTURES (E.G., DOCKS, LANDINGS, PILINGS, RIPRAP, ETC.)																			
LITTORAL FISH HABITAT CLASSIFICATION																			
DISTURBANCE (H=HUMAN N=NATURAL M=MIXED)																			
COVER CLASS (C=COVER, O=OPEN, M=MIXED)																			
COVER TYPE (A=ARTIFICIAL F=FILL V=VEG. W=WOODY B=BOULDERS M=MIXED N=NONE)																			
SUBSTRATE (M=MUD/MUCK, S=SAND/GRAVEL, C=COBBLE/BOULDER, B=BEDROCK)																			
GEAR (G=GILL NET, T=TRAP NET, S=SEINE, 0=NONE)																			
GEAR LOCATION (DIST. & DIR. TO NEAREST REPRES. MACROHABITAT)																			

FLAG CODES: K = MEASUREMENT OR OBSERVATION NOT OBTAINED; U = SUSPECT MEASUREMENT OR OBSERVATION;

F1, F2, ETC. = MISC. FLAGS ASSIGNED BY EACH FIELD CREW. EXPLAIN ALL FLAGS ON SEPARATE PHYSICAL CHARACTERIZATION HABITAT COMMENTS FORM.

REVIEWED BY (INITIAL): _____

Page ____ of ____

VISIT #: **1** **2**

OTHER: _____

[illegible]

FLAG CODES: **K** = NO MEASUREMENT OR OBSERVATION ATTEMPTED; **U** = SUSPECT MEASUREMENT OR OBSERVATION;
F1, F2, ETC. = MISC. FLAGS ASSIGNED BY EACH FIELD CREW.

CHECK HERE IF INFORMATION IS RECORDED ON OTHER SIDE OF FORM _____

REVIEWED BY (INITIAL): _____

LAKE ID: _____ L

**PHYSICAL HABITAT CHARACTERIZATION
COMMENTS FORM (continued)**

VISIT #: 1 2

[illegible]

CHECK HERE IF AN ADDITIONAL COMMENTS FORM IS USED _____

FLAG CODES: **K** = NO MEASUREMENT OR OBSERVATION ATTEMPTED; **U** = SUSPECT MEASUREMENT OR OBSERVATION;
F1, F2, ETC. = MISC. FLAGS ASSIGNED BY EACH FIELD CREW.

REVIEWED BY (INITIAL): _____

PHYSICAL HABITAT SKETCH MAP FORM-LAKES

LAKE NAME:

VISIT #: 1 2

LAKE ID: _____ L

START TIME: _____ : _____

END TIME: _____ : _____

TEAM ID (circle): 1 2 3 4 5 6 7 8 9 10 OTHER: _____

Sketch and label riparian, in-lake, shoreline, and littoral fish habitats around the lake, using codes below. To identify littoral fish habitats on the map, compose a four-character code as: (Disturbance) (Cover class) (Cover type) (Substrate type). EXAMPLE: NCVS for Natural, Cover, Vegetated, Sand/Gravel.

RIPARIAN AND IN-LAKE CODES: WET = Wetland; BCH = Beach; RSD = Residences; PRK = Park; FST = Forest; ALT = Altered shoreline; DCK = Dock(s); MNA = Marina; CRP = Cropland; PTR = Pasture; LFL = Landfill/Dump; IND = Industry; MNG = Mining; LGG = Logging; FLM = Floating macrophytes; SBM = Submerged macrophytes; EMM = Emergent macrophytes; SHL = Shoal or Rocks.

LITTORAL FISH HABITAT CODES: (DISTURBANCE): Human, Natural, Mixed. (COVER CLASS): Cover, Open, Mixed. (COVER TYPE): Artificial structure, Fill, Vegetated, Woody, Boulders, Mixed, None. (SUBSTRATE TYPE): Mud/Muck, Sand/Gravel, Cobble/Boulders, Bedrock.

MAP OF FISH SAMPLING SITES ON BACK

REVIEWED BY (INITIAL): _____

USE THIS MAP TO LOCATE LITTORAL MACROHABITAT TYPES AND FISH SAMPLING SITES

RECORD FISH SAMPLING STATIONS AND GEAR TYPE

(G = GILL NET, T = TRAP NET, M = MINNOW TRAP, B = BEACH SEINE, S = SHORT SEINE. EXAMPLE: F1G, F2T, ETC.).

IF A SITE IS SELECTED FOR ADDITIONAL STANDARD PROTOCOL OR JUDGEMENT SAMPLING, ADD AN "X" OR "J" TO THE STATION AND GEAR TYPE CODES.

EXAMPLE: F10GX, F4BJ, ETC.

MACROHABITAT CLASSIFICATION AND EXTENT SUMMARY

MACROHAB. CLASS (XXXX)	% EXTENT(S) AND TOTAL	STATIONS	COMMENTS
	= %		
	= %		
	= %		
	= %		
	= %		
	= %		
	TOTAL = %		

REVIEWED BY (INITIAL): _____

FISH TALLY FORM-LAKES										Page ____ of ____
LAKE NAME: _____								VISIT #: 1 2		
LAKE ID: _____ L			TEAM ID (circle): 1 2 3 4 5 6 7 8 9 10 OTHER: _____							
NEAREST P-HAB STATION (A - J, X): _____						DIST. & DIR. FROM STATION: _____		SITE ID: F _____		
SAMPLING EFFORT INFORMATION										
START CREW INITIALS: _____, _____, _____					END CREW INITIALS: _____, _____, _____					
START DATE: ____ / ____ / ____					END DATE: ____ / ____ / ____					
START TIME: ____ : ____					END TIME: ____ : ____					
LITTORAL HABITAT CLASSIFICATION										
MACROHAB. CLASS (FROM SKETCH MAP FORM): _____					MICROHAB. CLASS (FOR FISHING SITE): _____					
PELAGIC HABITAT CLASSIFICATION (circle one)										
ISOTHERMAL		EPIIMNION			METALIMNION			HYPOLIMNION		
SAMPLING GEAR INFORMATION (circle one)										
GILL NET		TRAP NET	MINNOW TRAP	BEACH SEINE		SHORT SEINE		OTHER (SPECIFY): _____		
TYPE OF GILL NET SET (CIRCLE):				TOTAL AREA SEINED : _____ M ²						
LITTORAL MIDWATER/ SURFACE BOTTOM				TOTAL NUMBER OF SEINE HAULS = _____						
FISHING DEPTHS: MINIMUM: ____ . ____ M MAXIMUM: ____ . ____ M										
COMMENTS:										

CHECK HERE IF NO FISH WERE COLLECTED: _____

JAR ID (Barcode): _____

TAG ID: _____

Common Name: _____					SPECIES CODE: _____			FLAG: _____	
Adult			Juvenile			YOY			
TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:	
Common Name: _____					SPECIES CODE: _____			FLAG: _____	
Adult			Juvenile			YOY			
TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:	

REVIEWED BY (INITIAL): _____

LAKE ID: _____ L									FISH TALLY FORM (continued)			SITE ID: F _____			VISIT #: 1 2		
Common Name: _____						SPECIES CODE: _____						FLAG: _____					
Adult			Juvenile			YOY											
TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:			

Common Name: _____						SPECIES CODE: _____						FLAG: _____		
Adult			Juvenile			YOY								
TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:

Common Name: _____						SPECIES CODE: _____						FLAG: _____		
Adult			Juvenile			YOY								
TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:

IF > 5 SPECIES ARE COLLECTED, CHECK HERE AND USE A TALLY CONTINUATION FORM _____

IS THERE EVIDENCE OF STOCKING (circle)?				YES NO	
---	--	--	--	-------------	--

SPECIES CODE	ANOMALY/ STOCKING CODE	# OF FISH	FLAG	SPECIES CODE	ANOMALY/ STOCKING CODE	# OF FISH	FLAG

ANOMALY/STOCKING CODES: D = Deformities; E = Eroded fins; L = Lesions or ulcers; T = Tumors; F = Fungus; X = Multiple D,E,L,T anomalies; B = Blind in one or both eyes; K = Emaciated; M = Excessive mucus; P = Heavy Infestation of external parasites; Z = Other (explain in comments); S = Stocking.

FLAG	COMMENTS

FLAG CODES: K=NO MEASUREMENT OR OBSERVATION MADE; U= SUSPECT MEASUREMENT OR OBSERVATION; **F1, F2, ETC.**= MISC. FLAGS ASSIGNED BY FIELD CREW. EXPLAIN ALL FLAGS IN COMMENTS SECTION. ATTACH SEPARATE COMMENTS SHEET IF NECESSARY.

REVIEWED BY (INITIAL): _____

FISH TALLY CONTINUATION FORM-LAKES							Page ____ of ____		
LAKE ID: _____ L _____				SITE ID: F _____			VISIT #: 1 2		

JAR ID (Barcode): _____ TAG ID: _____

Common Name: _____						SPECIES CODE: _____			FLAG: _____	
Adult			Juvenile			YOY				
TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:		

Common Name: _____						SPECIES CODE: _____			FLAG: _____	
Adult			Juvenile			YOY				
TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:		

Common Name: _____						SPECIES CODE: _____			FLAG: _____	
Adult			Juvenile			YOY				
TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:		

Common Name: _____						SPECIES CODE: _____			FLAG: _____	
Adult			Juvenile			YOY				
TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:		

Common Name: _____						SPECIES CODE: _____			FLAG: _____	
Adult			Juvenile			YOY				
TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:		

Common Name: _____						SPECIES CODE: _____			FLAG: _____	
Adult			Juvenile			YOY				
TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:		

Common Name: _____						SPECIES CODE: _____			FLAG: _____	
Adult			Juvenile			YOY				
TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:		

CHECK HERE IF INFORMATION IS RECORDED ON OTHER SIDE OF FORM: _____
 REVIEWED BY (INITIAL): _____

LAKE ID: _____ L			FISH TALLY CONTINUATION FORM (continued)			SITE ID: F			VISIT #: 1 2		
Common Name: _____					SPECIES CODE: _____			FLAG: _____			
Adult			Juvenile			YOY					
TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:

Common Name: _____					SPECIES CODE: _____			FLAG: _____			
Adult			Juvenile			YOY					
TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:

Common Name: _____					SPECIES CODE: _____			FLAG: _____			
Adult			Juvenile			YOY					
TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:	TOTAL	MUSEUM	# MEASURED FOR LENGTH:

CHECK HERE IF AN ADDITIONAL CONTINUATION FORM IS REQUIRED: _____

SPECIES CODE	ANOMALY/ STOCKING CODE	# OF FISH	FLAG	SPECIES CODE	ANOMALY/ STOCKING CODE	# OF FISH	FLAG

ANOMALY/STOCKING CODES: D = Deformities; E = Eroded fins; L = Lesions or ulcers; T = Tumors; F = Fungus; X = Multiple D,E,L,T anomalies; B = Blind in one or both eyes; K = Emaciated; M = Excessive mucus; P = Heavy infestation of external parasites; Z = Other (explain in comments); S = Stocking.

FLAG	COMMENTS

FLAG CODES: K = NO MEASUREMENT OR OBSERVATION MADE; U = SUSPECT MEASUREMENT OR OBSERVATION; Q = UNACCEPTABLE QC CHECK ASSOCIATED WITH MEASUREMENT; F1, F2, ETC. = MISC. FLAGS ASSIGNED BY EACH FIELD CREW. EXPLAIN ALL FLAGS IN COMMENTS SECTION.

REVIEWED BY (INITIAL): _____

[illegible]

CHECK HERE IF AN ADDITIONAL FISH LENGTH FORM IS USED FOR THIS LAKE: _____

* A = ADULT; J = JUVENILE; AND Y = YOUNG OF YEAR.

FLAG CODES: K = NO MEASUREMENT COLLECTED; U = SUSPECT MEASUREMENT; F1, F2, ETC. = MISC. FLAGS ASSIGNED BY FIELD CREW. EXPLAIN ALL FLAGS IN COMMENTS SECTION.

REVIEWED BY (INITIAL):_____

FISH TISSUE SAMPLE TRACKING FORM-LAKES						
LAKE NAME: _____			DATE PREPARED: / /		VISIT #: 1 2	
LAKE ID: _____ L		TEAM ID (circle): 1 2 3 4 5 6 7 8 9 10 OTHER: _____				
	SPECIES CODE	COMMON NAME	TOTAL LENGTH (MM)	WEIGHT (KG)	FLAG	SAMPLE ID (BARCODE)
1	_____	_____	_____	_____	_____	_____
2	_____	_____	_____	_____	_____	_____
3	_____	_____	_____	_____	_____	_____
4	_____	_____	_____	_____	_____	_____
5	_____	_____	_____	_____	_____	_____
6	_____	_____	_____	_____	_____	_____
7	_____	_____	_____	_____	_____	_____
8	_____	_____	_____	_____	_____	_____
9	_____	_____	_____	_____	_____	_____
10	_____	_____	_____	_____	_____	_____
11	_____	_____	_____	_____	_____	_____
12	_____	_____	_____	_____	_____	_____
13	_____	_____	_____	_____	_____	_____
14	_____	_____	_____	_____	_____	_____
15	_____	_____	_____	_____	_____	_____
16	_____	_____	_____	_____	_____	_____
17	_____	_____	_____	_____	_____	_____
18	_____	_____	_____	_____	_____	_____
19	_____	_____	_____	_____	_____	_____
20	_____	_____	_____	_____	_____	_____
# OF STATIONS FROM WHICH FISH TISSUE CANDIDATE SPECIMENS WERE COLLECTED: _____ TOTAL # OF STATIONS SAMPLED: _____						
LINE #	FLAG	COMMENT OR FLAG EXPLANATION				

CHECK HERE IF MORE DATA ARE RECORDED ON OTHER SIDE: _____

FLAG CODES: **K** = NO SAMPLE COLLECTED; **U** = SUSPECT SAMPLE; **F1, F2, ETC.** = MISC. FLAGS ASSIGNED BY FIELD CREW.
 EXPLAIN ALL FLAGS IN COMMENTS SECTION.

REVIEWED BY (INITIAL): _____

LAKE ID: _____ L

FISH TISSUE SAMPLE TRACKING FORM

DATE PREPARED: / /

(continued)

VISIT #: 1 2

	SPECIES CODE	COMMON NAME	TOTAL LENGTH (MM)	WEIGHT (KG)	FLAG	SAMPLE ID (BARCODE)
1	_____					_____
2	_____					_____
3	_____					_____
4	_____					_____
5	_____					_____
6	_____					_____
7	_____					_____
8	_____					_____
9	_____					_____
10	_____					_____
11	_____					_____
12	_____					_____
13	_____					_____
14	_____					_____
15	_____					_____
16	_____					_____
17	_____					_____
18	_____					_____
19	_____					_____
20	_____					_____

LINE #	FLAG	COMMENT OR FLAG EXPLANATION

FLAG CODES: K = NO SAMPLE COLLECTED; U = SUSPECT SAMPLE; F1, F2, ETC. = MISC. FLAGS ASSIGNED BY FIELD CREW. EXPLAIN ALL FLAGS IN COMMENTS SECTION.

REVIEWED BY (INITIAL): _____

SAMPLE COLLECTION FORM-LAKES									
LAKE NAME:			DATE OF COLLECTION: / /				VISIT #: 1 2		
LAKE ID: _____ L			SITE ID (circle): INDEX OTHER: _____						
TEAM ID (circle): 1 2 3 4 5 6 7 8 9 10			OTHER: _____						
SECCHI DISK TRANSPARENCY									
DEPTH DISK DISSAPPEARS		DEPTH DISK REAPPEARS		CLEAR TO BOTTOM (X)		COMMENTS			
_____ M		_____ M							
WATER CHEMISTRY (4-L CUBITAINER AND 4 SYRINGES)									
SAMPLE ID # (Barcode)		SAMPLE TYPE	DEPTH COLLECTED	FLAG	COMMENTS				
_____		R1	M						
_____			M						
CHLOROPHYLL (TARGET VOLUME = 500 mL)									
SAMPLE ID # (Barcode)		SAMPLE TYPE	DEPTH COLLECTED	SAMPLE VOLUME	FLAG	COMMENTS			
_____		R1	M	mL					
_____			M	mL					
ZOOPLANKTON (FILL TO MARK ON BOTTLE = 80 mL)									
MESH SIZE	SAMPLE ID # (Barcode)		SAMPLE TYPE	LENGTH OF TOW	CONTAINERS NO. PRESERVED (✓)		FLAG	COMMENTS	
COARSE	_____		R1	M					
FINE	_____		R1	M					
	_____			M					
	_____			M					
SEDIMENT CORE SAMPLES (TARGET CORE LENGTH = 35 TO 40 CM)									
Collected at (circle): INDEX OTHER				If OTHER, record direction and distance from INDEX site:					
SAMPLE CLASS	SAMPLE ID # (Barcode)		SAMPLE TYPE	LENGTH OF CORE	INTERVAL From To		FLAG	COMMENTS	
TOP	_____		R1	CM	CM CM				
BOTTOM	_____		R1	CM	CM CM				
	_____			CM	CM CM				
	_____			CM	CM CM				

FLAG CODES: K = NO MEASUREMENT OR SAMPLE COLLECTED; U = SUSPECT MEASUREMENT OR SAMPLE;
F1. F2, ETC. = MISC. FLAGS ASSIGNED BY EACH FIELD CREW. EXPLAIN ALL FLAGS IN COMMENTS SECTION.

REVIEWED BY (INITIAL): _____

BENTHOS SAMPLE LOCATION AND COLLECTION FORM-LAKES

LAKE NAME:

DATE OF COLLECTION: / /

VISIT #: 1 2

LAKE ID: _ _ _ _ _ L

TEAM ID (circle): 1 2 3 4 5 6 7 8 9 10 OTHER: _ _ _

OUTLINE MAP OF LAKE (WITH PHYSICAL HABITAT STATIONS IDENTIFIED)

INDICATE LOCATIONS WHERE BENTHIC CORE SAMPLES ARE COLLECTED WITH THE LETTER OF THE NEAREST PHYSICAL HABITAT SITE (A - J).

ARROW INDICATES NORTH.

RECORD THE **SHALLOWER** OF THE FOLLOWING DEPTHS (FROM LAKE PROFILE FORM)

A) THE DEPTH OF TOP OF METALIMNION OR

B) THE DEEPEST DEPTH AT WHICH DISSOLVED OXYGEN \geq 5 MG/L

TARGET DEPTH M

COMMENTS:

REVIEWED BY (INITIAL): _____

BENTHOS SAMPLE LOCATION AND COLLECTION FORM (CONTINUED)					VISIT #: 1 2	
LAKE ID: _____ L				DATE OF COLLECTION: / /		
RECORD SAMPLING START TIME: _____ :			RECORD PROCESSING COMPLETION TIME: _____ :			
SAMPLE ID # (Barcode)	STATION ID	DEPTH COLLECTED	SUBSTRATE TYPE ^a	FLAG ^b	COMMENTS	
_____	A	M				
_____	B	M				
_____	C	M				
_____	D	M				
_____	E	M				
_____	F	M				
_____	G	M				
_____	H	M				
_____	I	M				
_____	J	M				
_____		M				
_____		M				
_____		M				
_____		M				
_____		M				
_____		M				

^a SUBSTRATE TYPE CODES: G = GRAVEL; S = SAND; C = SILT CLAY, OR MUCK; W = WOODY DEBRIS; O = OTHER (DESCRIBE IN COMMENTS)

^b FLAG CODES: K = NO SAMPLE COLLECTED; U = SUSPECT SAMPLE; F1, F2, ETC.= MISC. FLAGS ASSIGNED BY EACH FIELD CREW. EXPLAIN ALL FLAGS IN COMMENTS SECTION.

ZEBRA MUSSEL OBSERVATION AND COLLECTION			
STATION	OBSERVED (Y/N)	COLLECTED (Y/N)	COMMENTS
A			
B			
C			
D			
E			
F			
G			
H			
I			
J			
LAUNCH			
OTHER			

REVIEWED BY (INITIAL): _____

LAKE ASSESSMENT FORM				
LAKE NAME:		DATE OF VISIT: / /		VISIT #: 1 2
LAKE ID: L		TEAM ID (circle): 1 2 3 4 5 6 7 8 9 10 OTHER:		
LAKE SITE ACTIVITIES AND DISTURBANCES OBSERVED (INTENSITY: BLANK = NOT OBSERVED, L = LOW, M = MODERATE, H = HEAVY)				
RESIDENTIAL	RECREATIONAL	AGRICULTURAL	INDUSTRIAL	LAKE MANAGEMENT
___ RESIDENCES ___ MAINTAINED LAWNS ___ CONSTRUCTION ___ PIPES, DRAINS ___ TREATMENT PLANT ___ LANDFILL, DUMPING	___ PARKS, CAMPGROUNDS, BEACHES ___ PRIMITIVE PARKS, CAMPING, BEACHES ___ RESORTS ___ MARINAS ___ TRASH/LITTER ___ SURFACE FILMS, SCUMS, OR SLICKS	___ CROPLAND ___ PASTURE ___ LIVESTOCK	___ INDUSTRIAL PLANTS ___ MINES/QUARRIES ___ POWER LINES ___ POWER PLANTS ___ LOGGING ___ EVIDENCE OF FIRE ___ ODORS	___ MACROPHYTE CONTROL ___ LIMING ___ DRINKING WATER TREATMENT ___ ANGLING PRESSURE
GENERAL LAKE INFORMATION				
HYDROLOGIC LAKE TYPE	<input type="checkbox"/> RESERVOIR <input type="checkbox"/> DRAINAGE (OUTLETS PRESENT)		<input type="checkbox"/> SEEPAGE (NO OUTLETS OBSERVED)	
OUTLET DAMS	<input type="checkbox"/> NONE <input type="checkbox"/> ARTIFICIAL		<input type="checkbox"/> NATURAL	
LOW ELEVATION FLIGHT HAZARDS	<input type="checkbox"/> YES <input type="checkbox"/> NO			
MOTOR BOAT DENSITY	<input type="checkbox"/> HIGH <input type="checkbox"/> LOW		<input type="checkbox"/> RESTRICTED	<input type="checkbox"/> BANNED
GENERAL AESTHETICS	<input type="checkbox"/> PLEASANT <input type="checkbox"/> SOMEWHAT PLEASANT		<input type="checkbox"/> UNPLEASANT	
SWIMMABILITY	<input type="checkbox"/> GOOD <input type="checkbox"/> FAIR		<input type="checkbox"/> NOT SWIMMABLE	
LAKE LEVEL CHANGES	<input type="checkbox"/> ZERO <input type="checkbox"/> ELEVATION CHANGE = M			
SHORELINE CHARACTERISTICS (% of shoreline)				
FOREST/SHRUB	<input type="checkbox"/> RARE (<5%)	<input type="checkbox"/> SPARSE (5 TO 25%)	<input type="checkbox"/> MODERATE (25 TO 75%)	<input type="checkbox"/> EXTENSIVE (> 75%)
AGRICULTURE	<input type="checkbox"/> RARE (< 5%)	<input type="checkbox"/> SPARSE (5 TO 25%)	<input type="checkbox"/> MODERATE (25 TO 75%)	<input type="checkbox"/> EXTENSIVE (> 75%)
OPEN GRASS	<input type="checkbox"/> RARE (< 5%)	<input type="checkbox"/> SPARSE (5 TO 25%)	<input type="checkbox"/> MODERATE (25 TO 75%)	<input type="checkbox"/> EXTENSIVE (>75%)
WETLAND	<input type="checkbox"/> RARE (< 5%)	<input type="checkbox"/> SPARSE (5 TO 25%)	<input type="checkbox"/> MODERATE (25 TO 75%)	<input type="checkbox"/> EXTENSIVE (>75%)
BARREN (BEACH)	<input type="checkbox"/> RARE (< 5%)	<input type="checkbox"/> SPARSE (5 TO 25%)	<input type="checkbox"/> MODERATE (25 TO 75%)	<input type="checkbox"/> EXTENSIVE (>75%)
DEVELOPED	<input type="checkbox"/> RARE (< 5%)	<input type="checkbox"/> SPARSE (5 TO 25%)	<input type="checkbox"/> MODERATE (25 TO 75%)	<input type="checkbox"/> EXTENSIVE (>75%)
SHORELINE MODS. (DOCKS, RIPRAP)	<input type="checkbox"/> RARE (< 5%)	<input type="checkbox"/> SPARSE (5 TO 25%)	<input type="checkbox"/> MODERATE (25 TO 75%)	<input type="checkbox"/> EXTENSIVE (>75%)
QUALITATIVE MACROPHYTE SURVEY				
MACROPHYTE DENSITY	<input type="checkbox"/> ABSENT	<input type="checkbox"/> SPARSE	<input type="checkbox"/> MODERATE	<input type="checkbox"/> DENSE
EMERGENT/FLOATING COVERAGE (% LAKE AREA)	<input type="checkbox"/> 0 TO 25%	<input type="checkbox"/> 25 TO 50%	<input type="checkbox"/> 50 TO 75%	<input type="checkbox"/> > 75%
SUBMERGENT COVERAGE (% LAKE AREA)	<input type="checkbox"/> 0 TO 25%	<input type="checkbox"/> 25 TO 50%	<input type="checkbox"/> 50 TO 75%	<input type="checkbox"/> > 75%
DESCRIPTION:				

(Continued on reverse side)

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ACRONYMS AND ABBREVIATIONS

BPJ	Best Professional Judgment
DLGs	Digital Line Graphs
DO	dissolved oxygen
EMAP	Environmental Monitoring and Assessment Program
EPA	U.S. Environmental Protection Agency
GPS	Global Positioning System
GQ	geometric quality
ID	identification
ORD	Office of Research and Development
OSHA	Occupational Safety and Health Administration
P-Hab	physical habitat
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
SQ	signal quality
STARS	Sample Tracking and Reporting System
T	Top
TIME	Temporally Integrated Monitoring of Ecosystems
USGS	United States Geological Survey
YOY	young of year
YSI	Yellow Springs Instrument system

Measurement Units

ha	hectare
m	meter
ppm	parts per million